

CLAIM

1. A mask comprising:

5 a thin film for exposure that has a transmission portion and a non-transmission portion of a beam for exposure in a predetermined pattern;

10 a thick film portion that is formed around said thin film for exposure and that supports said thin film for exposure; and

a thin film for inspection that is formed at a distance from said thin film for exposure in a portion of said thick film, and that has a transmission portion and a non-transmission portion of said beam for exposure.

15 2. A mask as set forth in claim 1, wherein thickness and material of said thin film for inspection are equal to those of said thin film for exposure.

20 3. A mask as set forth in claim 1, wherein said non-transmission portion comprises a thin film, and said transmission portion comprises an aperture formed in said thin film.

25 4. A mask as set forth in claim 1, wherein said transmission portion comprises a thin film, and said non-transmission portion comprises a beam

scatterer for exposure formed on said thin film.

5. A mask as set forth in claim 1, wherein
the area of said thin film for inspection is
larger than said thin film for exposure, and the flexure
5 of said thin film for inspection is bigger than that of
said thin film for exposure.

6. A mask as set forth in claim 1, wherein
said thin film for inspection has said
transmission portions of which line width is different
10 each other.

7. A mask as set forth in claim 1, wherein
said thin film for inspection has portions in
which the density of said transmission portion is
different each other.

15 8. A mask as set forth in claim 1, wherein
said thin film for exposure comprises a first
vulnerable portion that the probability of pattern damage
is the highest in said thin film for exposure, and;
said thin film for inspection comprises a second
20 vulnerable portion that the probability of pattern damage
is higher than said first vulnerable portion.

9. A mask as set forth in claim 8, wherein
said second vulnerable portion comprises a
pattern of which line width is narrower than a pattern of
25 said first vulnerable portion.

10. A mask as set forth in claim 8, wherein
the density of said transmission portion of
said second vulnerable portion is higher than the density
of said transmission portion of said first vulnerable
5 portion.

11. A method of inspecting a mask having a thin
film for exposure having a transmission portion and a
non-transmission portion of a beam for exposure in a
predetermined pattern and a thick film portion that
10 supports said thin film for exposure and that is formed
around said thin film for exposure, comprising:

a step of performing inspection in a thin
film for inspection that is formed at a distance from
said thin film for exposure in a portion of said thick
15 film portion and that is having a transmission portion
and a non-transmission portion of a charged particle beam,
and;

a step of estimating a condition of said thin
film for exposure from a result of inspection in said
20 thin film for inspection.

12. A method of inspecting a mask as set forth in
claim 11, wherein

said thin film for inspection of which
thickness and material are equal to those of said thin
25 film for exposure is used.

13. A method of inspecting a mask as set forth in
claim 11, wherein

inspection in said thin film for inspection
comprises destructive inspection.

5 14. A method of inspecting a mask as set forth in
claim 11, wherein

a step of performing inspection in said thin
film for inspection comprises a step of measuring
quantity of flexure of said thin film for inspection,

10 and;

a step of estimating a condition of said thin
film for exposure comprises a step of measuring quantity
of flexure of said thin film for exposure.

15. A method of inspecting a mask as set forth in
15 claim 11, wherein

a step of performing inspection in said thin
film for inspection comprises a step of inspecting
internal stress in the bulge test, and;

20 a step of estimating a condition of said thin
film for exposure comprises a step of estimating internal
stress of said thin film for exposure.

16. A method of inspecting a mask as set forth in
claim 11, wherein

25 said transmission portion comprises an
aperture formed in said thin film for exposure and thin

film for inspection by a same etching step;
a step of performing inspection in said thin
film for exposure comprises a step of cutting a portion
of said non-transmission portion of said thin film for
5 inspection and observing an etching cross sectional shape
of said aperture in a cut surface, and;

a step of estimating a condition of said thin
film for exposure comprises a step of estimating an
etching cross sectional shape of said aperture of said
10 thin film for exposure.

17. A method of inspecting a mask as set forth in
claim 16, wherein

a step of performing inspection in said thin
film for inspecting comprises a step of measuring line
15 width uniformity of an etching in said thin film for
inspection in which said transmission portion of which
line width and/or interval are different is formed, and;
a step of estimating a condition of said thin
film for exposure comprises a step of estimating line
20 width uniformity of an etching of said thin film for
inspection.

18. A method of inspecting a mask as set forth in
claim 16, wherein

a step of performing inspection in said thin
25 film for inspection comprises a step of measuring an in-

plane uniformity of an etching in said thin film for inspection, and;

a step of estimating a condition of said thin film for exposure comprises a step of estimating an in-
5 plane uniformity of an etching of said thin film for exposure.

19. A method of inspecting a mask as set forth in claim 16, wherein

a step of performing inspection in said thin film for inspection comprises a step of measuring a line width of said transmission portion in said multiple thin film for inspection formed separately each other, and;
10 a step of estimating a condition of said thin film for exposure comprises a step of estimating an in-
15 plane uniformity of an etching of said thin film for exposure.

20. A method of inspecting a mask as set forth in claim 11, wherein

said transmission portion comprises an aperture formed in said thin film for exposure and thin film for inspection by a same etching step;
20 a step of performing inspection in said thin film for inspection comprises a step of obtaining a fluctuation of a line width and a corner rounding of when 25 an aperture formed actually is compared with a design

data of a thin film for inspection in said thin film for inspection that said transmission portion of which line width and/or interval are different is formed, and;

a step of estimating a condition of said thin

5 film for exposure comprises a step of correcting a pattern of an aperture formed actually in said thin film for exposure by using a fluctuation of a line width and a corner rounding obtained in said thin film for inspection, and

10 a step of detecting a defect of a pattern of a thin film for exposure by referring a corrected data and a design data of a thin film for exposure.

21. A method of inspecting a mask as set forth in claim 20,

15 comprising a step of correcting a defect by irradiating a focused ion beam to a defect of a pattern detected in said thin film for exposure, and;

20 performing collimating of a focused ion beam by irradiating a focused ion beam to said thin film for inspection.

22. A method of inspecting a mask as set forth in claim 11, wherein

25 a step of performing inspection in said thin film for inspection comprises a step of confirming presence or absence of destruction of a pattern formed in

said thin film for inspection in a narrower line width of a pattern formed in a portion that the probability of a pattern damage is the highest in said thin film for exposure, and;

5 in the case of confirming destruction of a
pattern in said thin film for inspection, said thin film
for exposure is estimated as a nonusable condition.

23. A method of inspecting a mask as set forth in
claim 11, wherein

10 a step of performing inspection in said thin
film for inspection comprises a step of confirming
presence or absence of destruction of a pattern of a
portion that said transmission portion is formed in said
thin film for inspection in higher density of said
transmission portion that the probability of a pattern
damage is the highest in said thin film for exposure,
and;

in the case of confirming destruction of a pattern in said thin film for inspection, said thin film for exposure is estimated as a nonusable condition.

24. A method of inspecting a mask as set forth in
claim 11, wherein

a step of performing inspection in said thin film for inspection comprises a step of confirming presence or absence of change of a pattern after cleaning

in said thin film for inspection in which said transmission portion of which line width and/or interval are different is formed, and;

 a step of estimating a condition of said thin

5 film for exposure comprises a step of estimating a pattern of said thin film for exposure after cleaning.

25. A method of inspecting a mask as set forth in claim 11, wherein

 a step of performing inspection in said thin

10 film for inspection comprises a step of confirming a foreign material remaining after cleaning in said thin film for inspection in which said transmission portion of which line width and/or interval are different is formed, and;

15 a step of estimating a condition of said thin film for exposure comprises a step of estimating a pattern of said thin film for exposure after cleaning.

26. A method of inspecting a mask as set forth in claim 11, wherein

20 a step of performing inspection in said thin film for inspection comprises a step of confirming a fluctuation of a line width of a pattern associated with deposition of contaminator by exposure in said thin film for inspection in which said transmission portion of which line width and/or interval are different is formed,

and;

a step of estimating a condition of said thin film for exposure comprises a step of estimating a pattern of said thin film for exposure after using said 5 thin film for exposure for exposure.

27. A method of producing semiconductor device performing a lithography process by using a thin film for exposure of a mask comprising:

a thin film for exposure having a 10 transmission portion and a non-transmission portion of a beam for exposure in a predetermined pattern;

a thick film portion that is formed around said thin film for exposure and support said thin film for exposure, and;

15 a thin film for inspection that is formed at a distance from said thin film for exposure at a portion of said thick film and is having a transmission portion and a non-transmission portion of said beam for exposure.

28. A method of producing a semiconductor device 20 as set forth in claim 27, wherein thickness and material of said thin film for inspection are equal to those of said thin film for exposure.